Cassegrain Instrument Adaptor System (CassIAS)

User's Manual

Version: May 16, 2005

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Observing With Cass Focus Instruments

The Cass Instrument Adaptor System (CassIAS) was built by Chris Anderson at the University of Wisconsin to facilitate observing with instruments mounted at the Cassegrain port. It is currently used with DensePak. In the future, the high throughput slit spectrograph from Yale (WHTSS) may make use of the CassIAS. The CassIAS is fed by the **WIYN Universal Fiber Feed (WUFF)**, which was constructed by Kent Honeycutt of Indiana University. The WUFF provides a mount for the instruments, as well as a pellicle.

!!!!!!!!!!!!!!!!!!! IMPORTANT !!!!!!!!!!!!!!!!!!!!!!!

SAFETY:
Daily inspections must be made by the OA of the CASSIAS cable wrap. In particular, the wrap-up must not interfere with the instrument or IFU bundle when the CassIAS is rotated to its extreme limits. Furthermore, tie-offs and routing of the cable wrap and IFU bundle must be inspected for breakage and/or possible catch points when the elevation is moved (90º or at 5º). **An instrument can be destroyed** if a bundle or cable wrap is caught when slewing the elevation. So please be patient while the OA does his/her job. Finally, with the tertiary mirror fold **removed**, the elevation axis is unstable. The telescope **must** be moved slowly, with elevation speed set to 0.5 degree per second.

Starting Up

The CassIAS provides not only the optics to feed to the WUFF/instrument, but also the comparison lamps for calibrations, a guider camera, and an interface to the rotator. In order to use the CassIAS for on-sky observing, an OA or WIYN support staff must initialize the CassIAS ROTATOR. This can take up to 5 minutes, so be prepared. It is not necessary to initialize the rotator to obtain comparison lamp calibrations and zeros.

Nominal telescope focus
The nominal telescope focus change from MiniMo to the CassIAS with DensePak is around –1000 units.

Rotator Limits
The rotator can move from +90° to -90°. Observations of a target should be planned so that the rotator will not hit a limit, as the rotator unwrap will take several minutes.

The CassIAS GUI:
The CassIAS contains three mirrors that can be inserted into the light path. Two of the mirrors contain holes allowing light to pass through to the detector. The third is a solid

mirror used for target acquisition. On the backside of the acquisition mirror is another

mirror that directs light from the CuAr and ThAr comparison lamps onto the detector. The CassIAS also contains a guider camera that can be positioned. The CassIAS GUI controls all these functions. This GUI also allows the pellicle in the WUFF to be inserted for target positioning on the detector, and removed for observations. All of these are described in more detail below.

Figure 1 shows a snapshot of the CassIAS GUI interface. The interface is normally run on the OA's computer, but can be called up as a window on other computers via ssh. It is a fairly simple interface that allows either the OA or the observer to control the various functions of the CassIAS. To initialize the CassIAS, click on the "init all" button on the GUI, or send a command to move any of the axes (this automatically initializes the CassIAS). Figure 1 shows the setup of the CassIAS prior to initialization.

Clicking on the "stop all" button on the GUI will literally **stop all**, whether it is the guider camera moving in x and y, changing focus, changing mirror position, or sliding the pellicle in or out. So make sure you want to stop all movement before hitting that button!

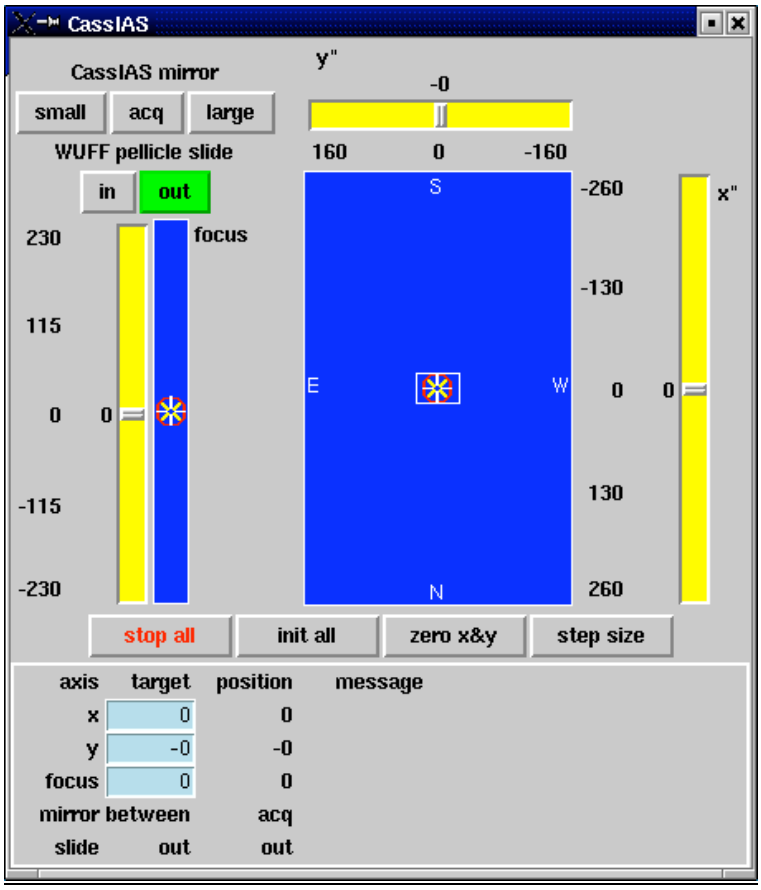

Figure 1 The CassIAS Control GUI. This image indicates the appearance of the GUI when the CassIAS before it is first initialized. (The slider bars appear yellow.)

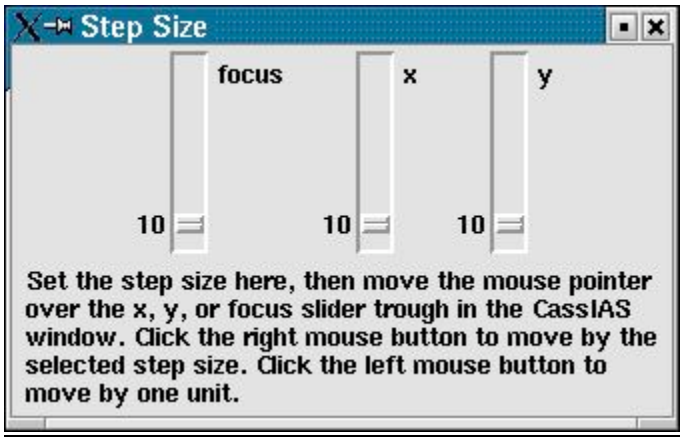

Figure 2 The pop-up window that appears when the "step size" button is selected on the CassIAS GUI. One can select the step size for the focus (in microns), as well as the x and y movement of the guider camera (in arcseconds).

CassIAS Guider Camera:

The CassIAS uses a Stanford ICCD camera and uses an ICCD controller modified for it. The pixel scale is 0.09"/pixel, and the field of view (FOV) accessible to the guide camera is +148" to –114" East to West and +272" to –252" North to South. Figure 1 indicates the size and orientation of the guider camera field of view (North down, East to the left), as well as the size. Thus, if the telescope is offset to the East, then the CassIAS camera stage must be moved West to reacquire the target. Remember that the **useable** FOV is this region with a hole in two of the three mirrors subtracted out to allow light to pass directly to the detector. There are two hole sizes, which are described below, and are indicated on the CassIAS GUI when the appropriate mirror(s) are selected.

The FOV of the guider TV is 36" in x and 50" in y, and is indicated by the small white rectangle with a white crosshair in the center on the GUI. This symbol moves instantly as you move the slider bars, and it can also be dragged around using the mouse pointer. When you release the mouse button (whether you are using the slider bars or dragging the rectangle), a "move" command is then sent to the motor control program. The target position of the guide camera that has been accepted by the motor control program is shown as a red circle. When a new target position has been accepted by the program, the red circle will immediately indicate the new position, and the rectangle+cross hair will follow the movement of the x and y axes to the new position. Finally, there is a yellow "x" which marks the actual position of the camera, as reported by the encoders. Figure 3, below, shows the three different symbols separated out.

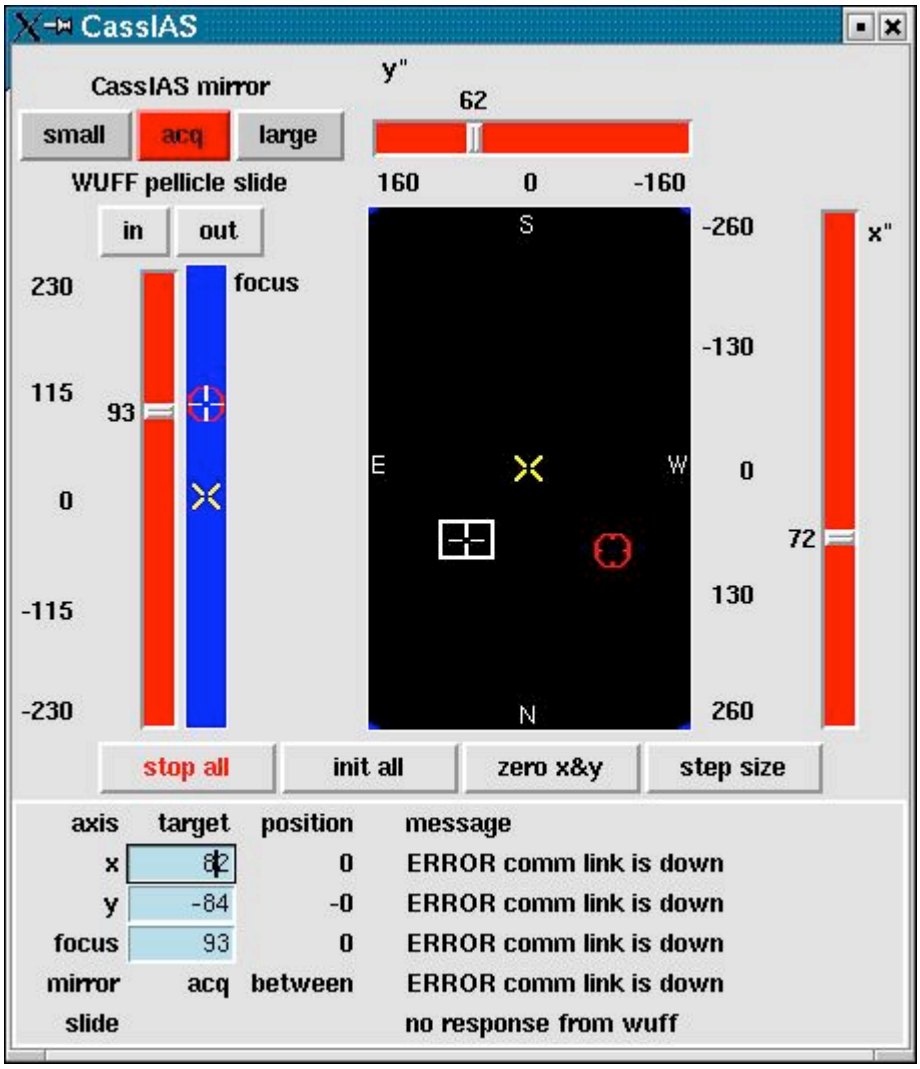

Figure 3 The CassIAS Control GUI with the three target symbols separated out. The white rectangle and crosshair indicate the guider camera FOV, and are used to position the guider. The red circle indicates the guider camera target position. The yellow "x" indicates the guider camera position according to the encoders, and moves with the guider. The slider bars appear red because the CassIAS hardware was not connected when this image was taken.

The guider camera can also be focused using the GUI. Note that the focus stage (Z stage) has a range of —210 to 213 µm of secondary motion. The focus is either controlled by the slide bar on the left of the GUI or by typing in a specific focus in µm in the focus box on the lower left.

Mirror Positions:

There are three mirror positions. Moving the guider camera to the different mirror

positions is done with the CassIAS GUI, using the buttons in the upper left corner of the

GUI.

Small Center Hole – This mirror is selected by clicking on the "small" button on the upper left corner of the GUI. This position has a small center hole (to direct light to the detector), and a correspondingly larger guider field. It is ideal for DensePak, as the hole has a diameter of 86". Note that the hole in this mirror is not centered on the optical axis. It is centered at 17" N and 8" W of field center, as can be seen in Figure 4. Thus, the unvignetted field for guiding is –26"<x<-252" S, 60"<x<272" N, -51"<y<-114" W, and 35"<y<148" E.

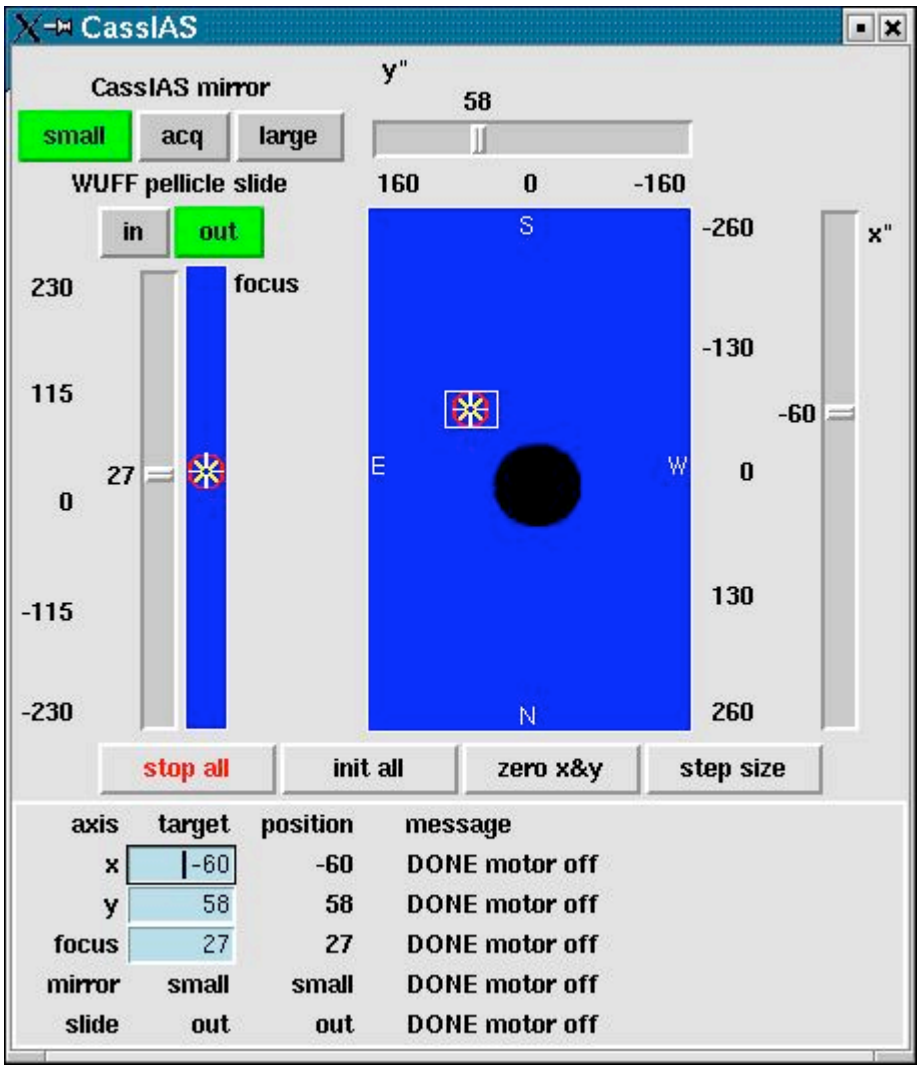

Figure 4 The CassIAS GUI after selecting "small" (CassIAS mirror with a small hole) and offsetting the guider probe to –60" in x (south), and 58" in y (east). The central black hole correctly indicates the size and location of the mirror hole.

Acquisition Mirror – This mirror is selected by clicking on the "acq" button on the upper left corner of the GUI. The acquisition mirror has no hole (light from entire field goes directly to the acquisition TV). The backside of this mirror sends calibration light to the instrument. Calibrations can be in progress while acquiring the target field using WUFF.

Large Center Hole – This mirror is selected by clicking on the "large" button on the upper left corner of the GUI. It has a large hole in center (directs light to detector), and a correspondingly smaller guide field. The hole has not been precisely measured, but does appear to be centered on x=y=0, and is approximately ±100" N/S and ±120" E/W (diameter of 200"x240"). It is represented on the GUI by a round hole with a radius of 120". Until the hole can be carefully measured, we recommend assuming an unvignetted field size for guiding that is –120"<x<-252" S, 120"<x<272" N, no guide field W, and 120"<y<148" E.

Aquiring a Target:
Move mirror to "**acq**" on the CassIAS GUI. Move the guider probe to 0,0 by clicking on the "zero x&y" button on the GUI. Once you have located your target, choose either the large or small mirror hole, and insert the pellicle by clicking on the "in" button under the WUFF pellicle slide area of the GUI in the upper left corner.

Please note that on the WUFF/Pellicle TV, the orientation is approximately East down and North to the left. There is likely to be some small rotation from true East down, North to the left, as there are no fiducial marks for placing detectors in the WUFF mount. The center of rotation with DensePak on the CassIAS port is fiber 48. Using a bright star, you can (1) check the center of rotation, (2) mark where a star falls on the acquisition TV if placed on fiber 48 (or whatever fiber you select), and (3) determine the amount of rotation of the WUFF/Pellicle TV from East down, North to the left. You can then have the OA input a rotator offset angle, just as is done at the WIYN port for DensePak and SparsePak. That rotator offset angle will then remain the same unless changed manually by the OA, so the orientation will be fixed.

Place your target on the desired fiducial (with DensePak, this is often fiber 42, the center fiber). Remove the pellicle from the field of view by clicking on the "out" button under the WUFF pellicle slide area of the GUI in the upper left corner. Move the mirror to "**small**" or "**large**", whichever you choose. Note: This must be done before you can see the target with either the WUFF TV or the acquisition TV.

Guiding at Cass
Currently, to locate a guide star within the available FOV the OA does a manual search, as this isn't correctly integrated into the guide star software yet. (Note: The OA must have the CIAS camera input to channel 0 on the B-level of the dome.). The OA can bring up the guide stars that are available using the guide star software, but the offsets must be input *manually* in the x & y boxes on the CassIAS GUI in the lower left. As a rough

guideline, the limiting magnitude in 0.8" seeing, with dark clear sky, should be 16th mag. Once a guide star has been located in the available FOV, adjust Cass IAS probe focus using either the focus bar or the focus box on the CassIAS GUI. The OA can start guiding, and you should be good to observe. [If you have good astrometry for stars within 200" of your field, then calculating the offsets from your target and providing them to the OA may speed up this process.]

Calibration Lamps

There are CuAr and ThAr calibration lamps mounted inside the CassIAS. To access the lamps, they must be connected into the system by Instrument Support or an OA. This should be done at the start of your observing run. The lamps are controlled by a calibration GUI on *ivory's* desktop. This is the same GUI as is used with the imager on the WIYN port for doing dome flats.

We will add additional information on exposure times with the different gratings as they are used. With DensePak, the 600 l/mm grating, a collimator angle of 30º, a collimator focus of –5, and a central wavelength of 6600Å, Di was able to identify bright lines in a 10 second exposure, and faint lines in a 180 second exposure. With the GG420 filter and the 600 l/mm grating @13.9º, focus of –9, and a central wavelength of 6700Å, the exposure times were 10 seconds for bright lines and 120 seconds for faint lines.

Dome Flats

Select the mirror position you intend to observe with using the CassIAS GUI. As with the information on the calibration lamps, we will add to this as information becomes available. With DensePak, the 600 l/mm grating @13.9º, a collimator angle of 30º, a collimator focus of –5, and a central wavelength of 6600Å, Di was able to achieve a peak of >30,000 counts in a 12 second exposure. The flat lamps were at 3200. A similar result was achieved for the GG420 filter and the 600 l/mm grating @13.9º, focus of –9, and a central wavelength of 6700Å.